

REPORT

OF THE

County Medical Officer of Health

DELEGATED BY THE COUNTY COUNCIL

TO ATTEND THE

MEETINGS OF THE SANITARY CONGRESS,

Held in Leeds, September, 1897.

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The Congress of the Sanitary Institute,

LEEDS, SEPTEMBER 14-18, 1897.

AT the request of the County Council I attended the Meetings of this Congress. As full reports of the proceedings, and abstracts of the papers read, have appeared in a considerable number of journals, I purpose referring only to those bearing upon one or two subjects of special interest to this County.

DISPOSAL OF SEWAGE.

I am so constantly consulted with regard to the disposal of sewage that this subject received my chief attention. The questions most usually asked are :—

1. What standard of purity should be adopted for sewage effluents, or, in other words, what is a satisfactory effluent?
2. Can any system of treatment be recommended whereby the use of land for irrigation purposes can be dispensed with?
3. Is it possible to adopt any system of treatment whereby no sludge will be produced?

With reference to the first question, I have always refrained from giving a definite answer until I have become perfectly acquainted with the general character of the sewage dealt with and the nature of the stream into which the effluent has to be discharged. It is obvious that the effluent sent into a large tidal river need not be so highly purified as an effluent discharged into a small fresh water stream.

Even if cast into a tidal river, much greater care must be taken when the foreshore is utilized for the culture of shell-fish. By correspondence with various Conservancy Boards, River Boards, County Medical Officers of Health, and others, I have obtained a mass of information with regard to this subject, and am acquainted with probably all the provisional standards adopted throughout the country. Much of this information is of a private character, since it is generally held that at present it would be unwise to fix any definite standard. When this subject came up, incidentally, at the Congress, this opinion was endorsed by all those who were conversant with the subject.

The second question receives a stereotyped answer. Many systems have been recommended by their discoverers as capable of so purifying ordinary sewage as to dispense with land filtration. So far, all the processes which have had a long and continuous trial have proved more or less unsatisfactory, and the Local Government Board will not give their sanction for a loan for any system of treatment which does not include land irrigation. Within the last year or so other systems have been advocated, and these will be referred to presently, which it is claimed will not only efficiently purify sewage without being supplemented by land filtration, but will also so affect the suspended matters that no sludge is produced. How far these claims will be justified by experience remains to be seen. This, at present, is practically the only answer which can be given to the third question.

The papers read at the Congress bearing on these points were of an interesting character. They were contributed by Mr. Donald Cameron, Mr. Dibdin, Dr. Barwise, and others.

Modern research has established beyond doubt that the processes of purification of the future will be "bacteriological" rather than purely chemical. By the agency of bacteria the organic matter in the sewage can be broken up and most of it converted into two innocuous inorganic bodies, nitric and carbonic acid. This change takes place when manure is used for fertilizing the soil, and when sewage is passed

through suitable land. The problem, therefore, is—can artificial means be devised whereby this change can be brought about with sufficient rapidity and with sufficient economy as to render irrigation unnecessary, and at the same time can the insoluble as well as the soluble organic matter be acted upon, or will it still be necessary to separate the former and have the trouble and expense of dealing with the sludge?

Mr. Donald Cameron, the City Surveyor of Exeter, claims that he has devised a process which prevents the formation of sludge, and so efficiently purifies sewage that land irrigation is unnecessary. There are two stages in this process. In the first the raw sewage flows through a dark underground tank cut off from access of air and it occupies about 24 hours in traversing this tank. Here it is stated that those organisms which flourish best in the absence of air and light so act upon the insoluble organic matters as to render them soluble, and so affect the organic matter generally as to render it more easily oxidizable in the next stage of the process. This consists in aerating the tank effluent and passing it through beds of coke breeze. The breeze holds large quantities of air (and therefore of oxygen) in its pores, and the organisms which effect the oxidizing process here flourish and the organic matter is rapidly converted into innocuous inorganic compounds of nitrogen and carbon.

This “septic tank system” can only be regarded as still on trial. Many have faith in it merely because they have had occasion to observe that sometimes when a cesspool has been opened with the expectation of finding it full of solid matter, it has been found to contain practically none. I have noticed something of this kind, but the most rapid change of insoluble fœcal matter into the liquid form which I have observed took place in a large tank which was open both to light and air. This tank received all the sewage from a small town and collected the solids. One summer, when the receptacle was nearly full of solids, a kind of rapid fermentation set in, the effluent from it became of a reddish yellow colour, and contained an enormous amount of organic matter in solution, and practically the whole of the solid

matter in a few days had disappeared. This is conclusive proof to me that insoluble filth can be dissolved without recourse to air-tight or light-tight tanks, provided we can get the right organism or organisms and set them to work therein. I have seen the Exeter system at work and have examined both sewage and effluent therefrom, besides having carefully considered all the analyses and reports which have been published having reference thereto. The sewage being treated is very dilute, it cannot be compared with the sewage produced in most of our Essex towns and large villages. The evidence that the solid matter becomes digested in the "septic tank" is not conclusive. So far as I can judge, it does not take place to any appreciable extent. The chief change takes place in the breeze filter beds after the sewage has passed through the tank. I have asked the Syndicate or Company whether they would consent to a trial being made in this county, but they have not replied thereto.

Mr. Dibdin, who until recently was Chemist to the London County Council, has conducted a series of experiments with the London sewage at Barking, and is decidedly of opinion that sewage can be efficiently purified by passing it through one or more coke breeze filters, properly constructed and duly charged with proper organisms. He states that in such a filter the insoluble matters are dissolved, and that 90 per cent. and upwards of the organic impurity can be converted into innocuous inorganic matter. Precipitating agents, antiseptics, and "septic tanks" are in his opinion either useless or worse than useless. The results published by him seem to confirm his views, and I saw at Leeds that special filter beds were being constructed to give his process a practical trial. The results will, no doubt, be published in due course.

These coke breeze filters are now being tried in a town producing 500,000 gallons of sewage per day, but only a portion of this sewage is being treated. From time to time samples of the sewage and effluent have been submitted to me for analysis, and the results so far are very satisfactory. The Town Council have made an additional grant, and a further portion of the sewage is to be so treated.

Mr. Adney has conducted a series of experiments showing that the purification of sewage by bacteria takes place in two stages. In the first the organic matter is broken down into carbonic acid and ammonia, and in the second the ammonia is oxidized to nitric acid. For both these processes an adequate supply of Oxygen was found to be absolutely necessary. Without oxygen, putrefactive changes set in and offensive products are formed. Based on these researches, Mr. Parry and Mr. Adney have devised the system of purification referred to in the abstract of the paper read by Mr. Parry at the Leeds Congress. I understand that the system is being tried at Halifax, but I have not had the opportunity of seeing it, nor have I seen any report enabling me to form an opinion as to its efficiency.

At Lichfield and Wolverhampton filters have been constructed of fine coal, and Professor Bostock Hill, who read a paper on the subject, regards the results as very satisfactory. The opinion was expressed that coal would prove to be a better medium for bacterial filtration than coke, and that it was capable of producing a higher degree of purification even than land.

Col. Ducat, an ex-inspector of the Local Government Board, who has given great attention to the subject of sewage purification, has had some special bacterial filters put down at Hendon. The object aimed at is the more thorough aeration of the sewage to enable the bacteria to destroy the organic matter more rapidly. I applied for permission to visit the Hendon works, but was informed that the filter was being re-constructed, and my visit, therefore, was postponed.

The conclusion at which I have arrived is that we are within a measureable distance of the time when the purification of sewage by means of microbes will become an accomplished fact. Coarse straining to remove masses of solid matter will probably always be necessary, or at least desirable, but the sludge nuisance will cease to exist. The sewage will be purified without the production of sludge, and land irrigation will no longer be required. At the present

time, however, the experimental works have not been conducted on a sufficiently large scale or for a sufficiently long period of time to enable me to recommend any one process in preference to another, or to say with confidence that any process yet devised is certain to be satisfactory.

WATER SUPPLIES.

This subject was discussed at the Sanitary Congress, and especial reference made to the importance of greater precautions being taken to prevent the sources from which public supplies are derived becoming polluted. Still greater attention has been directed to this subject by the serious epidemics of Typhoid Fever now raging at Maidstone and Kings Lynn. In future years these epidemics will probably be considered as blessings in disguise. They have emphasized, as only such calamities can, the imperative necessity of constant skilled supervision over all sources from which communities, be they large or small, derive their supplies for domestic purposes.

Those who have an extended acquaintance with the public supplies for this country know that there are many towns using water from sources quite as liable to pollution as were the Farleigh springs at Maidstone, or the stream at Lynn, and that it is merely by accident that Maidstone and Lynn rather than other towns have suffered. There are already numerous signs that the lessons of these epidemics are being taken to heart, and Sanitary Authorities and Water Companies who hitherto have been content with an occasional analysis and favourable report are having their sources of supply examined. A considerable amount of nonsense has appeared in the public press, and some of the suggestions therein made are so impracticable that if acted upon many towns would be deprived of supplies of excellent water which by the adoption of proper precautions could be rendered entirely safe from pollution. There are many extensive districts in which the water from the subsoil and superficial springs is alone available, and there is no doubt in the minds of those who have made a special study of the

subject that, in most cases, such supplies can be rendered as safe as those from deeper sources, and safer than those derived from open streams, or collected on exposed impermeable surfaces. The Royal Commission on Metropolitan Water Supply considered that even a polluted river water could be rendered quite safe by efficient filtration, that is by passing slowly through a few feet of fine sand. The water in the subsoil, whether pumped direct or derived from springs, is water which has passed very much more slowly through strata of natural filtering material very much more efficient than any artificially constructed filter bed of sand. Whereas the latter acts mechanically only, the former acts biologically also, the organisms in the soil destroying any organic matter present in the water, converting it into harmless inorganic nitrates and carbonates. All that is necessary, therefore, is to protect the area around the site from which the water is derived so as to prevent the access of any water save such as has been efficiently purified by percolation through a sufficient mass of soil.

Hitherto Water Companies and Sanitary Authorities have been permitted to acquire merely the springs or the site for their wells, whereas they should have acquired sufficient of the land around in order to have absolute control over it to prevent pollution. This protective area will probably in future always be insisted upon, and its extent will have to be defined in each individual case. The conditions vary so greatly that no general rule can be adopted. In deciding, many factors will have to be taken into account, the contour of the ground, the depth of the subsoil, the extent of variation in the ground water level, the nature of the subsoil, possible sources of pollution, the area affected by pumping operations, the amount of water to be abstracted, the mode in which it is collected, etc.

The Maidstone and Lynn outbreaks will also serve to direct increased attention to the immense stores of underground water, within comparatively easy reach in many districts, yet which are greatly neglected. Imprisoned at a considerable depth in pervious strata overlaid by impervious clays, the water is naturally protected from pollution, and if

derived from properly constructed wells is usually of the highest organic purity. Unfortunately deep wells are not always free from defects, sufficient care not being taken to exclude water from superficial pervious strata.

As the mere fact of a water being derived from a deep well or boring is usually considered to be a sufficient guarantee of its purity, it is desirable to bear in mind that defects in construction may admit of pollution. When such a well is lined with iron cylinders, the subsoil water, possibly polluted, may find its way down outside the tube and enter at lower points. From time to time such wells should be examined to ascertain whether such leakage is taking place, and an area around the well should be so protected as to keep the subsoil in the immediate vicinity free from pollution. This subterranean water travels chiefly in the rock fissures. Hence if impurities can enter directly into such fissures on the exposed surface of the outcrop they may be carried very considerable distances. Where there is also an outcrop under the sea, the continual reduction of the water level by heavy pumping may cause the cone of depression to extend so far that the sea water will enter. Unless the known outcrops of the water bearing stratum are at a very considerable distance, they also should be examined to ascertain, if possible, whether there is any danger of pollution. Water from running streams, save in exceptional cases, cannot be considered safe unless sufficient storage is provided to render it unnecessary to collect water from the stream when in flood, and ample provision for filtration has been made. A stream which is known to be polluted by sewage should not be utilized for a public water supply if any better source is available, but where, for any cause, a purer source is not in command, unremitting attention must be paid to every detail of collection and filtration if a catastrophe is to be avoided.

Where upland surface waters are impounded, the example of Glasgow should be imitated, and control over the whole watershed secured.

I am sufficiently well acquainted with the water supplies in this county to be able to affirm that certain of

them are not efficiently protected, and I think that the County Council would do well to consider whether they cannot do something towards safeguarding the public. No Authority or Water Company with satisfactory supplies would object to their sources being examined periodically by me as your Medical Officer of Health, neither would any Authority or Company really anxious to safeguard their supplies object to such inspection. I regard a careful examination of the source of a water as being much more important than any number of analyses, and I do not think any authority or company is justified in attempting to shield themselves behind an analysis without the source being fully examined to ascertain whether pollution is possible. I do not, by any means, desire you to infer that analyses are unnecessary, they are desirable as a supplement to an examination of the source, and occasions do occur when an analysis will reveal pollution, the source of which had previously been unsuspected.

I would have inspections made at regular intervals, say once a year, and analyses every quarter or every month, or even oftener, according to the importance of the supply:

JOHN C. THRESH.
